

## Forward

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This workbook contains Compliance Verification Guidance (CVG) material developed for selected NASA safety and mission assurance policy directives and standards. The CVG information is presented in several formats intended to enhance user awareness and understanding of the SMA requirements and to help the user prepare for future SMA compliance verification audits. Awareness is the first step toward compliance. A heightened NASA community awareness of NASA SMA requirements will help foster the NASA safety culture and inevitably will lead to greater and more frequent access of official policy documents.

Note: The CVG material is intended to complement the official NASA Policy Directives and Procedural Requirements (NPDs and NPRs) located in the NASA Online Directives Information System (NODIS) and should never be considered or used as a replacement for these official documents.

This workbook is the central focus of the September 14-16, 2004 Compliance Verification Workshop held in Boulder, Colorado. Participants at this workshop are asked to review and examine the CVG materials with particular emphasis on the following questions:

- Are the most important key SMA requirements identified?
- Is the most appropriate objective quality evidence (OQE) necessary to verify compliance with key SMA requirements identified?
- Does the CVG material contain appropriate application references and examples?
- Is the intent and use of the requirement clearly evident in all CVG material?

Participants are also encouraged to comment on proposed Programmatic and Institutional audit processes described in the appendices of this workbook.

Potential workshop participants are those responsible for complying with or ensuring compliance with NASA SMA requirements, including: Center Operation Directors, Center SMA Managers, Center Safety Managers, and program/project managers. Other organizations involved in compliance verification, e.g., the Independent Program Assessment Office, Center Systems Management Offices, are also invited to participate.

Special thanks to the OSMA Civil Servant and contractor team that has labored mightily over the past several months to reach this point in the development of CVG material. Thanks also to the workshop participants whose contributions will be critical to reaching the next level of maturity in the CVG documents and ultimately in implementing effective compliance with NASA safety & mission assurance requirements.

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### **Group 1 – Overarching SMA Philosophy & Policy Documents**

Safety and Mission Assurance (NPD 8700.1)

Risk Management (NPR 8000.4)

Safety Manual (NPR 8715.3)

### **Group 2 – Institutional / Operational Safety Documents**

Safety and Health (NPD 8710.2 and NPR 8715.1)

Facility Safety (NASA-STD-8719.7)

Pressure Vessels (NPD 8710.5 and NPR 8715.4)

Underwater Facility Safety (NASA-STD-1740.10)

Lifting Devices (NASA-STD-8719.9)

Fire Protection (NASA-STD-8719.11)

Aviation Safety (NPR 7900.3)

### **Group 3 – Program Implementation**

Reliability and Maintainability (NPD 8720.1 and NASA-STD-8729.1)

Probabilistic Risk Assessment (NPR 8705.5)

Limiting Orbital Debris Generation (NPD 8710.3)

Range Safety (NPR 8715.X)

Software I V & V (NPD 8730.4)

Software Safety and Assurance (NASA-STD-8739.8 and NASA-STD-8719.13)

Parts Policy (NPD 8730.2)

GIDEP (NPR 8735.1)

Metrology and Calibration (NPD 8730.1)

Explosives Safety (NASA-STD-1740.12)

### **Group 4 – Program Class – Requirements**

Spacecraft, Instruments, and Launch (NPD 8700.3)

Payloads (NPD 8610.7, NPD 8705.X, and NASA-STD-8719.8)

Expendable Launch Vehicles (NPD 8610.23, NPD 8610.24, and NASA-STD-8709.2)

Experimental Aerospace Vehicles (NPD 8700.2 and NPR 8705.3)

Human-Rating (NPR 8705.2)

### **Group 5 – Contingency / Recovery / Investigation**

Continuity of Operations (NPD 1040.4 and NPR 1040.1)

Emergency Preparedness (NPD 8710.1 and NPR 8715.2)

Mishap Investigations (NPD 8621.1 and NPR 8621.1)

### **Appendices**

Appendix A – Review & Assessment Approach

Appendix B – Programmatic Review & Audit Process

Appendix C – Institutional Review & Audit Process

## **1.0 Introduction: NASA Core Values & Transformation Context**

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The NASA Administrator recently articulated a set of core values including safety, the NASA family, excellence, and integrity. His commitment to safety was made clear in the recent organizational transformation in which the Chief Safety and Mission Assurance Officer was identified as one of three direct reports to the Administrator.

Since the loss of Columbia and the subsequent Columbia Accident Investigation Board (CAIB) report, numerous safety-related initiatives have been undertaken within NASA, several of which move beyond the immediate Space Shuttle return-to-flight activities. These include the Safety Culture Survey and follow-up "intervention," the "Diaz Report," the Submarine Safety Colloquium, Safety-Critical Decision-Making Training, and the streamlining of NASA safety and mission assurance related policy directives and standards.

The CAIB report and the NASA / Navy Benchmarking Exchange (NNBE) both discussed the strengths of moving toward a "requirement / compliance" safety culture similar to that implemented in the nuclear submarine Navy. Attributes of that culture include:

- Safety requirements are clearly documented and achievable, with minimal use of waivers or tailoring.
- Requirements are implemented through capable and carefully controlled processes.
- Compliance is verified through rigorous in-line management control and assurance processes.
- Compliance is also verified independently of program management by a separate compliance verification organization.

The Office of Safety and Mission Assurance is currently taking a next step forward in achieving this transformation to a new safety culture by more effectively communicating safety and mission assurance requirements through the development of SMA compliance verification guides. These guides will become part of a rigorous verification of compliance through periodic audits and reviews.

## **2.0 Compliance Verification Guidance Material Development Process**

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The Review & Assessment Division (QV) identified an initial set of 60 NASA safety and mission assurance related requirements documents for analysis and formatting into CVG products. The requirement set included 23 documents identified by the Safety and Assurance Requirements Division (QS) during the Headquarters NPD and NPG requirements review plus 27 Code Q Standards and several documents belonging to other HQ organizations. The team also reviewed the OSMA "SMARTS" database as well as all direct references cited in the individual SMA requirement documents (180 references). The analysis and development process entailed over six weeks of iterative collaborative work between members of all of the Office of Safety and Mission Assurance divisions and a group of support contractors. Further review, comment, and discussion within OSMA is anticipated and will be addressed along with input from the September CVG workshop.

### **Requirements Documents and OPR**

The scope of the SMA requirements is not limited to the NPDs and NPRs that identify OSMA as the Office of Primary Responsibility (OPR). Currently, the SMA requirements set includes all NPDs, NPRs, and NASA Standards with OSMA designated as the OPR, three NPDs with the Office of Space Flight as the OPR, and one NPR with the Office of Institutional and Corporate Management as the OPR. Each OPR is the final authority for interpretation of specific requirements. The three NPDs with the Office of Space Flight as the OPR are included because their existence is a requirement of NPD 8700.1 Safety and Mission Success. Also, these directives are direct references of 8700.3 SMA Policy for NASA Spacecraft, Instruments, and Launch Services. The one NPR with the Office of Institutional and Corporate Management as the OPR is included because the NPR is directly related to safety of aviation

operations. In the future, other SMA requirements within the responsibility of any NASA agency office may be incorporated into this workbook.

## **SMA Requirement Documents Organized into 5 Audit Groups**

### **Group 1 – Overarching SMA Philosophy & Policy Documents**

Safety and Mission Assurance (NPD 8700.1)  
Risk Management (NPR 8000.4)  
Safety Manual (NPR 8715.3)

### **Group 2 – Institutional / Operational Safety Documents**

Safety and Health (NPD 8710.2 and NPR 8715.1)  
Facility Safety (NASA-STD-8719.7)  
Pressure Vessels (NPD 8710.5 and NPR 8715.4)  
Underwater Facility Safety (NASA-STD-1740.10)  
Lifting Devices (NASA-STD-8719.9)  
Fire Protection (NASA-STD-8719.11)  
Aviation Safety (NPR 7900.3)

### **Group 3 – Program Implementation**

Reliability and Maintainability (NPD 8720.1 and NASA-STD-8729.1)  
Probabilistic Risk Assessment (NPR 8705.5)  
Limiting Orbital Debris Generation (NPD 8710.3)  
Range Safety (NPR 8715.X)  
Software I V & V (NPD 8730.4)  
Software Safety and Assurance (NASA-STD-8739.8 and NASA-STD-8719.13)  
Parts Policy (NPD 8730.2)  
GIDEP (NPR 8735.1)  
Metrology and Calibration (NPD 8730.1)  
Explosives Safety (NASA-STD-1740.12)

### **Group 4 – Program Class – Requirements**

Spacecraft, Instruments, and Launch (NPD 8700.3)  
Payloads (NPD 8610.7, NPD 8705.X, and NASA-STD-8719.8)  
Expendable Launch Vehicles (NPD 8610.23, NPD 8610.24, and NASA-STD-8709.2)  
Experimental Aerospace Vehicles (NPD 8700.2 and NPR 8705.3)  
Human-Rating (NPR 8705.2)

### **Group 5 – Contingency / Recovery / Investigation**

Continuity of Operations (NPD 1040.4 and NPR 1040.1)  
Emergency Preparedness (NPD 8710.1 and NPR 8715.2)  
Mishap Investigations (NPD 8621.1 and NPR 8621.1)

### **Other NASA SMA Documents To Be Developed (In-Work)**

#### **Group 2 Institutional/Operational Documents**

*Facility Operational Readiness NSS 8719.1 (still under development)*

#### **Group 3 Program Implementation**

*Hydrogen Safety (recently replaced by the AIAA standard)*  
*Software Formal Inspection NASA-STD-2202-93*  
*Software Engineering Requirements NPR 7150*  
*Software Documentation NASA-STD-2100-91*  
*Quality Policy NPD TBD,*  
*Cabling and Crimping NASA-STD-8739.4,*  
*Soldering NASA-STD-8739.3,*

*Surface Mount NASA-STD-8739.2*  
*Conformal Coating NASA-STD-8739.1*  
*Fiber Optics NASA-STD-8739.5*

## **Key SMA Requirements Identified**

Key SMA requirements are subjectively defined as the main requirements directly related to safety and mission assurance that drive secondary requirements. Each key SMA requirement is expected to contain four critical elements:

- (1) A clearly defined responsible party performing
- (2) A very specific action resulting in
- (3) A clearly identifiable result with
- (4) Clearly identifiable objective quality evidence (OQE).

The proposed OQE forms the basis for verifying compliance to the SMA requirements.

Key requirement examples include 1) leadership requirements such as establishing or implementing an assurance capability or organization, 2) core assurance process requirements involving specific planning and/or analysis activity, and 3) verification requirements including reviews or assessments.

## **3.0 CVG Products**

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This document contains CVG resources for 28 topics covering 40 of the 60 identified documents. Others are in development. All of these products will evolve over time, incorporating revisions to the official documents, lessons learned and suggestions from individual auditors, audited organizations, document owners, and subject matter experts. This continual learning feedback loop is shown in figure 1.

### **3.1 Brochure**

The Brochure provides the NASA community with an understanding of key SMA audit requirements related to a particular subject and provides pertinent information highlighting the importance of the requirements or provides further detail regarding the requirements. The brochures are tri-fold with the inside panels detailing the objective, the requirements, and the related OQE. The outside panel includes some introductory audit questions that the reader can expect during an SMA audit. This information is intended to help prepare the reader for an SMA audit.

### **3.2 One-Page Brief**

The One-Page Brief is a compact reference serving as an introduction to the complete requirements document contained in NODIS. The front page includes the process objective, key OQE, and the requirements divided into three categories: Leadership and Management, Core Process, and Process Check. Leadership and Management include requirements that establish and approve the implementation of detailed procedures, guidelines, and decision-making criteria and train personnel. Core Process includes requirements that plan, analyze and implement SMA requirements. Process Check includes requirements that verify that the Core Process requirements were executed appropriately. The back page contains a comparative matrix of principal and supporting roles and responsibilities.

### **3.3 Questionnaire**

The Questionnaire provides an introductory set of questions for auditors to employ in conducting audits. The audit questions are intended to begin the process of going beyond digital (yes/no) compliance and address the quality and depth of compliance. The Questionnaire corresponds to one or more key SMA audit requirements and assists the auditor in identifying OQE.

### **3.4 Compliance Verification Abstract**

The Abstract defines the key SMA audit requirements and any requirements necessary to add context derived from the NPD, NPR, and related references. The format organizes the requirements into three types of requirements and three categories and identifies the responsible party, the specific action, and the expected OQE. The three types of requirements are Programmatic, Institutional, and Functional. Programmatic requirements relate directly to the Programs within NASA. Institutional requirements relate directly to the Centers and Facilities. Functional requirements relate directly to centralized functions such as OSMA, Contracts, Chief Medical Officer, Chief Engineer, etc. The three categories are identical to the categories in the One-Page Brief. Where possible the responsible party has been defined as a single person to drive accountability to SMA requirements. The expected OQE is only a suggestion and should not be interpreted as the only way to satisfy a requirement.

Note: The CVG material is intended to complement the official NASA Policy Directives and Procedural Requirements (NPDs and NPRs) located in the NASA Online Directives Information System (NODIS) and should never be considered or used as a replacement for these official documents.

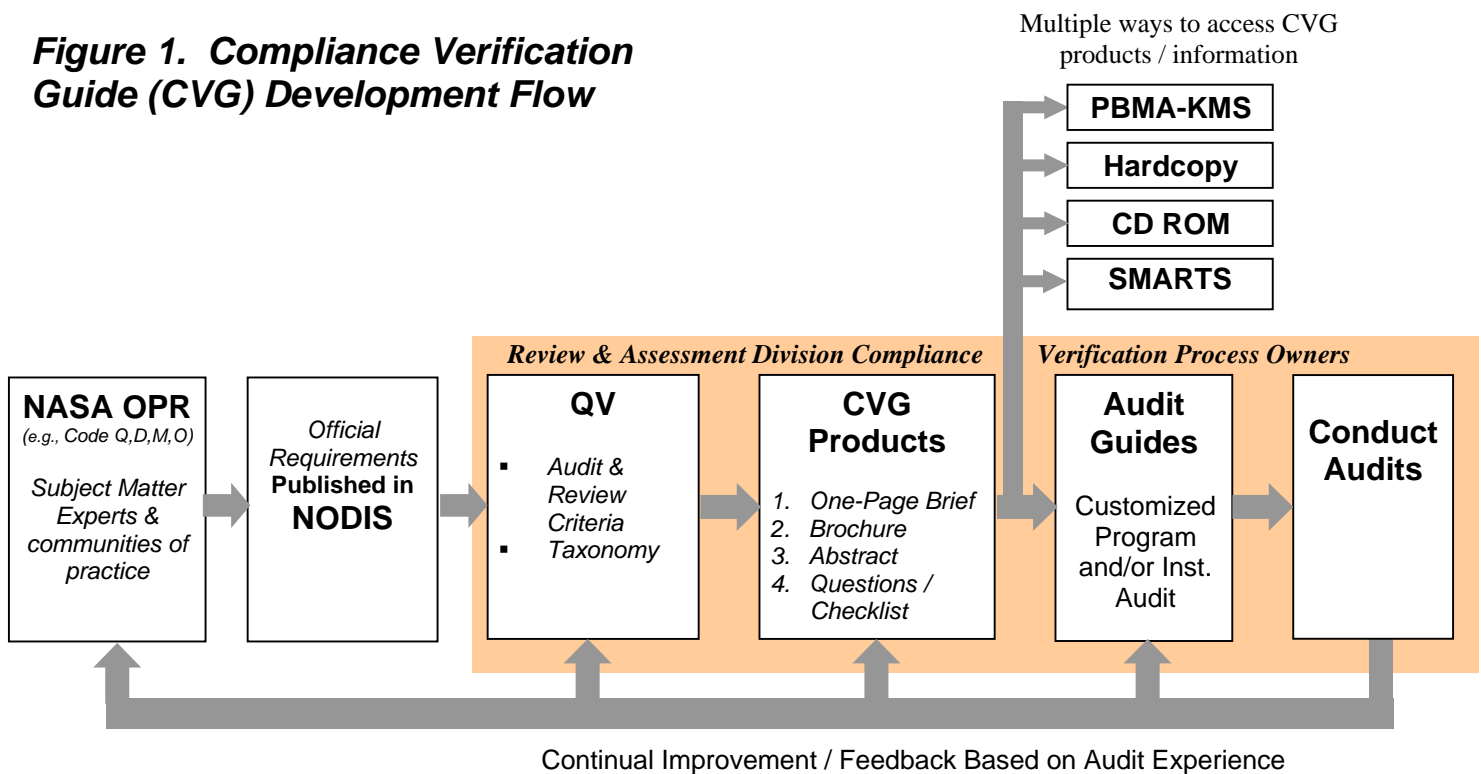
## 4.0 CVG Material Access and Configuration Management

The Review and Assessment Division (QV) is using a multi-path delivery approach to afford wide access to the NASA community. All workshop draft CVG material is accessible to "NASA.gov" via the Process Based Mission Assurance - Knowledge Management System (PBMA-KMS) at

<http://pbma.nasa.gov/cvguides/index.html>.

The PBMA-KMS will serve as the configuration managed CVG information hub. All CVG information is (will be) version date-indexed. Revisions will most often reflect updates based on audit experience. Changes and updates will also be implemented to reflect changes in parent documents that are formally codified in the NODIS system. CVG information will also be available in the future on the SMARTS system. Hardcopy and CD-ROM formats will also be available.

**Figure 1. Compliance Verification Guide (CVG) Development Flow**





## 5.0 Review & Assessment Division Audit Processes

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The Review and Assessment Division has developed both programmatic and institutional audit processes. Customized audit guides will be developed for a program (or for an institution) that reflect consideration of relevant information including recent past audits, self audits, previous audit findings, current events, NASA SMA Annual Operating Agreements, program/project maturity.

### 5.1 SMA Programmatic Review and Audit

The SMA Program Review and Audit process (see Appendix B) is designed to develop knowledge of SMA program requirements, gain visibility into capabilities and compliance levels and understanding of residual risk associated with operational readiness decisions. Other elements of the SMA Programmatic Review and Assessment process include:

- **Making a Decision to Audit:** using a program selection criteria to determine which programs to audit, and developing a core audit team to provide sustaining support and identify additional audit SMEs to support periodic audits.
- **Conducting Program Discovery:** researching and compiling documentation and information to characterize the program, and tracking assurance flow and identifying roles and responsibilities by developing Assurance Process Maps and Matrices for both new and existing programs.
- **Baselining the Requirements:** defining program-specific SMA requirements for new programs, and identifying SMA requirements gaps for existing programs.
- **Verifying Requirements Flow-down:** checking that the baseline SMA requirements are being flowed down through the NASA program to the prime contractor and subcontractor activities.
- **Verifying Process Capability:** assessing each implementing organization to ensure there is sufficient SMA “water pressure” (i.e., sufficient staffing, skill mix, tools, funding, etc.) and implementing a corrective action process, if required.
- **Verifying Requirements Compliance:** ongoing surveillance to initiate and track objective quality evidence (OQE), and conducting periodic Code QV verification of implementation of the baseline SMA requirements.
- **Supporting Operational Readiness:** summarizing audit and review findings (i.e., baseline SMA requirements flow-down, implementation, compliance) for the Chief Safety and Mission Assurance Officer, and presenting a residual risk profile for any SMA requirements issues.

### 5.2 SMA Institutional Review and Audit

The SMA Institutional Review and Audit process will focus on identifying OQE that verifies compliance to NASA SMA requirements levied on Center and component facilities and operations. The audit process includes a clearly defined set of audit requirements defined in groups 1, 2, and 3 of this workbook and a structured audit process outlined in Appendix C. The audit process will leverage other third-party activities such as Operational Readiness Inspections; OSHA Inspections and Evaluations; Quality Inspections; Federal Aviation Administration (FAA) Inspections; Department of Energy (DOE) Audits; Inter-center Mishap and Close-Call Investigations; Nuclear Regulatory Commission; Agency Environmental, Medical, and Health Audits; NASA Engineering & Safety Center (NESC); Operations Engineering Panel; Aircraft Operations Panel; Interagency Nuclear Safety Review Panel; and Aerospace Safety Advisory Panel. The result of the audit process is an independent, objective, and constructive evaluation of the effectiveness and efficiency of a Center’s implementation of SMA requirements.

### **5.3 IPAO Agreement (in-work)**

An agreement is being established between the Office of Safety and Mission Assurance (OSMA) Review and Assessment (R&A) Division (Code QV) and the Office of the Chief Engineer Independent Program Assessment Office (IPAO) to coordinate their conduct and participation in OSMA Programmatic R&A activities and IPAO R&A activities.

The agreement documents and formalizes discussions between R&A Division and the IPAO for sharing of audit process details, tools and results and for coordinating safety and mission assurance (SMA) program/project review and assessment activities between the two organizations. The goals are: (1) to assist both organizations in their due diligence responsibilities while minimizing redundancy of actions and impact on NASA programs and projects and (2) to allow each organization to participate in, contribute to, and learn from each other's review, assessment, and audit processes.

## 6.0 Preliminary Compliance Verification Workshop Agenda

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### Monday, September 13, 2004

Arrive at **Millenium Harvest House Hotel**, Boulder, Colorado      Check-in

### Tuesday, September 14, 2004

- 7:30      Register/Name Tags – at the **Hotel Boulderado**
- 8:00      Welcome – Bryan O'Connor
- 8:30      Introduction – Dr. Steve Newman
- 9:00      Requirements Management/Development Status: Dr. Michael Stamatelatos
- 9:30      Programmatic Audit Process – Steve Wander
- 10:30      Break
- 10:45      Institutional Audit Process – Art Lee
- 11:45      Lunch with speaker  
            Mr. Al Ford Jr. PE, Deputy Director, Submarine Safety & Quality Assurance, Naval Sea Systems Command (NAVSEA 07Q)
- 1:00      Work Session 1  
            Group A: Programmatic – Audit Process Discussion  
            Group B: Institutional – Audit Process Discussion
- 4:00      Daily Review
- 4:30      Adjourn
- 6:00      Meet for Dinner

### Wednesday, September 15, 2004

- 8:00      Reconvene
- 8:30      Work Session 2  
            Group A: Programmatic – Program Implementation  
            Group B: Institutional – Overarching SMA Philosophy & Policy, Institutional/Operational Safety Group
- 12:00      Lunch with speaker  
            *(University of Colorado Laboratory for Atmospheric and Space Physics / arrangements in-work)*
- 1:00      Work Session 3  
            Group A: Programmatic – Program Specific Requirements Documents  
            Group B: Institutional – Program Implementation, Contingency/Recovery/Investigation
- 4:00      Daily Review
- 4:30      Adjourn
- 5:00      Optional Tours of the Laboratory for Atmospheric and Space Physics (LASP), a research organization at the [University of Colorado in Boulder](#). LASP has been an active participant in the U.S. space program since the early 1950s. Funded primarily by NASA, members of LASP conduct fundamental research in the atmospheric and planetary sciences, develop space instrumentation, and create computer information systems for space operations.

### Thursday, September 16, 2004

- 8:00      Out-brief
- 12:00      Adjourn  
            Travel Home

## 7.0 Comment Process

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Participants are encouraged to comment on all material within this workbook. Comments, recommendations, or proposed changes may be submitted using the form below. If proposing a specific change, please include the recommended wording and rationale or justification for the change. You are encouraged to submit feedback prior to the Compliance Verification Workshop, or you may also wait and discuss your recommendations during the workshop. All recommendations made during the workshop will be recorded for later disposition. To submit your feedback prior to or after the Compliance Verification Workshop, you may mail completed forms to the address below, or send an email containing the same information to [Jason.Swistak@ps.net](mailto:Jason.Swistak@ps.net) and [Garnisha.Young@ps.net](mailto:Garnisha.Young@ps.net).

Perot Systems Government Services  
1600 N. Beauregard St.  
Alexandria, VA 22311  
Attention: Garnisha Young

COMPLIANCE VERIFICATION WORKBOOK CHANGE REQUEST FORM	
DOCUMENT NUMBER/SUBJECT	SUBMITTING ORGANIZATION:  
DOCUMENT TYPE <input type="checkbox"/> BROCHURE <input type="checkbox"/> ONE-PAGE BRIEF <input type="checkbox"/> QUESTIONNAIRE <input type="checkbox"/> ABSTRACT <input type="checkbox"/> ALL	POINT OF CONTACT:  
	PHONE:  
	EMAIL:  
	DATE OF SUBMITTAL:  
PUBLICATION DATE	
INPUT	